PROPOSAL

Submitted To

LOUISIANA TECHNOLOGY INNOVATION FUND

By

Louisiana State University

February 19, 2002

I PROJECT TITLE:

Large-Scale Deployment of Virtual Linux Servers

II PROJECT LEADER

Ronald D. Hay, Executive Director and CIO
Office of Computing Services
Louisiana State University
Baton Rouge, LA 70803-1900
225/578-3710 FAX: 225/578-3709 Email: ronhay@lsu.edu

III EXECUTIVE SUMMARY

The LSU Office of Computing Services, with support from the Department of Computer Science, requests $805,190 for the acquisition of computing hardware and software to provide large numbers of students with their own secure and independent virtual Linux servers. The intent is to use z/VM and Linux/390 software on the S/390 hardware platform to establish a cost-effective, state-of-the-art computing environment for students and educators on a large-scale basis - all within a single logical partition. While creating new and innovative opportunities for LSU students, the strategy leverages and builds on the LSU investment in hardware, software and people. The timing for the project is excellent because of current efforts at LSU with Linux/390 in the area of server consolidation as part of a research project with IBM. The operational schedule will establish a pilot project with the Department of Computer Science in the fall of 2002 with plans to extend the services in the spring of 2003 to the College of Engineering and other departments with technical curricula, e.g., Experimental Statistics. The opportunity is here to provide general availability to leading-edge technology giving LSU students a competitive advantage in the job market, as well as enhancing their educational experience.

Technology today must be pervasive in all aspects of higher education including research, instruction and administration. The advent of Linux, characterized by IBM as “disruptive technology”, has the potential of changing the information technology world forever. LSU is proud of its history of innovative accomplishments in the enterprise technology arena and sees a unique opportunity with Linux/390 to make a quantum leap in providing advanced computing resources to students.

While the initial target user group is several hundred LSU students in technical curricula, the possibility exists to scale the services for numerous outreach programs including area schools and state government. This project looks to the future and the experience gained has the clear potential to save money and provide

the opportunity to transfer knowledge to non-academic computing areas. In that regard, the project includes a "success sharing" component to communicate the services to the campus, other educational institutions and state agencies.

IV DESCRIPTION OF THE PROJECT

A. Project Narrative

LSU requests funds to acquire computing hardware and software to provide large numbers of students with their own secure and independent virtual Linux server. The intent is to use z/VM and Linux/390 software on the S/390 hardware platform to establish a cost-effective, state-of-the-art computing environment for students and educators on a large-scale basis - all within a single logical partition. While creating new and innovative opportunities for LSU students, the strategy leverages and builds on the LSU investment in hardware, software and people. The timing for the project is excellent because it extends current efforts at LSU with Linux/390 in the area of server consolidation as part of a research project with IBM. An ambitious operational schedule is proposed including a pilot project with the Department of Computer Science in the fall of 2002 with plans to extend the services in the spring of 2003 to the College of Engineering's upperclassman and graduate courses and other departments with technical curricula, e.g., Experimental Statistics is interested in using the new Linux version of SAS as a key element of their curriculum. The opportunity is here to provide general availability to leading-edge technology giving LSU students a competitive advantage in the job market, as well as enhancing their educational experience.

Technology today must be pervasive in all aspects of higher education including research, instruction and administration. The advent of Linux, characterized by IBM as "disruptive technology", has the potential of changing the information technology world forever. LSU is proud of its history of innovative accomplishments in the enterprise technology arena and sees a unique opportunity with Linux/390 to make a quantum leap in providing advanced computing resources to students.

The first goal of this project is to provide secure and independent virtual Linux server environments to LSU students enrolled in technical curricula. The Linux systems will function just as if running on a standalone machine. The project will utilize the virtual capabilities of the IBM S/390 platform to provide these independent Linux servers on a large-scale basis. By building upon the current computing and communications infrastructure and the expertise of the technical staff at LSU, the objective is to provide these servers economically within the framework of existing services. Students will acquire accounts for their Linux server by using integrated web-based facilities just as they obtain email, digital library and similar services.

The anticipated outcomes of the project are multi-faceted. The priority is to integrate innovative technology into the technical curricula of multiple academic departments. For a large campus such as LSU, the scaling issues are critical and this proposal emphasizes a state-of-the-art approach to make a dramatic impact with efficient use of existing infrastructure and people resources. By providing reliable access to virtual Linux servers over the network, the need for separate labs running Linux software can be reduced, simplifying the management and support issues, as well as reducing hardware costs.

The hardware will be housed in the LSU Frey Computing Services Center - a modern facility occupied in 1995 - and will be available 7x24x365. The Linux services will be accessible through the Internet. The campus network includes over 15,000 data nodes connected to a multi-gigabit core. External connectivity includes robust and redundant access to commercial Internet providers, LaNet and Internet2. Therefore, these services will be readily accessible to students from on-campus including the residence halls and from off-campus locations.

The principal user community will include LSU students enrolled in technical curricula and their faculty. The technical support and system management will be provided by the Office of Computing Services (OCS). The initial academic department, in the fall 2002 semester, will be Computer Science with plans to expand the services to multiple departments including the College of Engineering and the Experimental Statistics Department followed by the Information Systems and Decision Sciences (ISDS) and possibly other departments within the College of Business, as appropriate. The range of academic activity on the Linux servers is limited only by the imagination of the students and faculty. The pilot project phase will use Linux/390 to concentrate on the study of operating systems. The student will have access to a dedicated Linux operating system with the ability to study the individual components and make dynamic changes. Potential for subsequent studies will include software development in an open source environment, software portability, graphics, website development and hosting, distributed computing, programming languages and the use of software packages including SAS and SAP, etc.

While the initial target user group is several hundred LSU students in technical curricula, the possibility exists to scale the services for numerous outreach programs including area schools and state government. This project looks to the future and the experience gained has the clear potential to save money and provide the opportunity to transfer knowledge to non-academic computing areas. In that regard, the project will include a "success sharing" component to communicate the services to the LSU campus and also communicate the results of our efforts to other educational institutions and state agencies. This training component will consist of on-campus seminars describing the availability of Linux services to the faculty and informational presentations to other educational institutions. Our experiences will also be communicated through training venues such as the annual CISD Conference.

The potential advantages to this project are many and can be summarized as follows:

* The ability to provide hundreds of Linux images on a single S/390 platform.
* The ability to create and manage dynamic Linux images quickly and easily as needed.
* The ability to share system resources among a multitude of Linux images.
* The ability to provide high-speed communication among Linux images.
* The ability to consolidate operations and servers into a single physical system.

See the technical description for details on the proposed deployment of technology for this project.

B. Use of Innovative Technology

Linux is at the forefront of a rapidly changing information technology environment and is approaching common acceptance as an open industry standard. The importance of Linux is evident by the fact that IBM has made Linux services available on their enterprise server platforms (mainframe) in anticipation of the next generation of E-business applications.

LSU proposes to offer virtual Linux systems to students by adding processor capacity, memory and disk to the existing IBM 9672-R36 hardware platform. The Linux/390 systems will be controlled using z/VM software with the ability to run hundreds of images in a logical partition separate from the enterprise production environment. The virtualization features will provide the student with access to a complete Linux environment without the need for additional standalone hardware.

In conjunction with IBM, LSU has already begun a research project to evaluate the feasibility of consolidating server functions on the enterprise server platform. The thrust of the research project is to explore the new Linux/390 services for common infrastructure server functions such as DNS, print servers, LDAP, List servers, etc. The objective is to simplify the management process and reduce the need for proliferating server farms. Early results with the research project have been positive but current hardware resources are insufficient to expand the environment to students.

While the LTIF request proposes a very different use of the Linux/390 facility, it certainly builds upon preliminary experience gained by the staff in the creation, management, and control of Linux/390 services.

C. Multi-agency Application or Portability to Other Agencies

This proposal is tailored to provide services within LSU to multiple academic departments. The ability to scale services to a large number of users is a key element to the project. Therefore, successful deployment on the LSU campus will indicate the ability to expand the services on a grand scale to other institutions of higher education, state agencies or even the K-12 community. LSU intends to leverage the experience gained with this project for the benefit of other State entities through seminars and other information sharing forums to enable broadening the delivery of Linux services on the S/390 platform. To our knowledge, there are no efforts within state government or higher education to exploit Linux/390 capabilities to the magnitude proposed on this project.

D. Benchmarking Partners and/or Best Practice References

Linux/390 services have been generally available for about two years. Principal applications have been in commercial sites with emphasis on server consolidation and more recently with the use of enterprise-wide E-business applications. Within higher education, several institutions have initiated comparable projects. Most notably, Marist College, a small liberal arts institution in Poughkeepsie, NY, is now providing several hundred Computer Science students with a virtual Linux environment on the S/390 platform as an integral part of their curriculum. This effort was done in partnership with IBM. As an extension of their project, test environments were used to scale the hardware platform to support over forty thousand Linux images.

The LSU proposal is similar to the Marist project in concept. However, the initial LSU objective is to provide virtual Linux servers on a course by semester basis across multiple academic departments - rather than provide a continuous computing environment for a single student for the duration of their academic career. The scaling issues are also of particular interest to LSU with regard to expanding Linux services to multiple agencies.

E. Long-range Planning

LSU is committed to providing quality computing services to the user community. Included in the campus master plan is the aspiration to be a leader in the application of information technology. This proposal is consistent with those strategic aspirations. To achieve these ambitious goals with limited resources, it is imperative that the hardware and software platforms scale appropriately. The IBM S/390 platform with the Linux/390 and z/VM software provides that capability.

F. Performance Goal

The ultimate measure of the success of the project will be the widespread deployment of Linux services to students and faculty in multiple academic departments. The specific measures of success will depend on the types of work performed by the students. However, based upon preliminary analysis of the proposed hardware resources and the needs of the campus, successful deployment will be demonstrated by the following:

*** - 300 students actively using virtual Linux/390 servers in course work after 2 years
*** - 6 courses per semester using virtual Linux/390 servers after 2 years
*** - 4 distinct academic departments using virtual Linux/390 servers in course work after 2 years

*** - Demonstration of the ability to support the Linux/390 system management function with the equivalent of 1 additional FTE. (Implicit here is the ability to absorb related issues such as storage and network management with existing personnel)

In addition to these objective goals, there are intangible goals, as well, including:

*** Potential cost-savings in the areas of server consolidation and reduced complexity
*** Enhanced student job qualifications
*** Technology transfer to other academic and non-academic entities including state government

G. Technical Approach

From a technical perspective, the goal of the project is to deliver managed, reliable, and secure Linux systems to the LSU community. The Linux systems will be virtual machines managed by IBM's z/VM operating system running on the LSU enterprise server complex. z/VM uses virtualization technology to create virtual computer systems that can be IPL'd, or booted up, with operating systems such as Linux. It is a stable, scalable, and secure platform and provides an excellent use of the LSU computing infrastructure with access to Shark SAN storage, mainframe processor power, and gigabit network backbone connectivity.

For the past year, LSU has partnered with IBM to investigate running Linux on the IBM 9672 enterprise server. We have tested Linux packages from both SuSE and Red Hat in a test logical partition (LPAR) and have recently loaded both under the control of z/VM as guest systems. Using information gathered from this work, we are confident that the proposed architecture is practical and applicable to the stated goals.

For the Linux systems created under z/VM control, we will standardize on Red Hat's Linux package for the mainframe, using the 2.4.9 kernel. This complete Linux server operating system has been ported to the IBM S/390 and Z/900 series mainframes in cooperation with IBM engineers and can run natively as the only system on the mainframe, in an LPAR alongside other operating systems such as OS/390, or under the control of z/VM. If using z/VM, many Linux systems can coexist and cooperate in a single LPAR.

Using a configured Linux system as a template, cloned Linux systems will be created, as needed, each with a unique TCP/IP network address and identity, storage space, and backup facilities. If desired, an existing Linux system can be "reloaded" and restored to its initial configuration quickly and easily.

In the z/VM LPAR, these Linux systems will use virtual network devices to communicate with each other and with the outside world (LSU network backbone) through the z/VM TCP/IP system. These z/VM virtual devices, or IUCVs (Inter User Communication Vehicles), are created dynamically when a Linux system boots up, minimizing overhead and management while maximizing resources. Subnetting and routing methodologies allow the formation of "penguin (the Linux mascot) colonies" (e.g., figure 2).

Using tailored templates to clone different classes of Linux systems, combined with the ability to segregate the resulting systems, provides a flexible platform for delivering Linux services as required by the campus community.

All the Linux systems are preloaded with the LSU standard backup facility, Tivoli Storage Manager, which delivers automated, scheduled backups overnight to the data center's central repository. A simple user interface provides easy recovery of lost or damaged data.

A LPAR will be created on the LSU IBM 9672 to host the z/VM-Linux environment. This LPAR isolates the environment from the rest of the mainframe system and functions as a separate

machine. The architecture permits the independent startup, shutdown, and maintenance of the environment without impacting processes and operating systems running in other mainframe partitions.

We will use new IBM IFL (Integrated Facility for Linux) processing engines to power the z/VM-Linux LPAR. These engines are designed to provide the power of a standard mainframe CPU but are restricted to running the z/VM operating system to host Linux guest virtual machines. This approach reduces purchasing, licensing, and support costs when compared to the comparable general-purpose processors. The IFL engines will be integrated into the IBM Enterprise Server chassis. This approach will provide another cost savings and minimize the overhead of maintaining a new processing platform.

The z/VM operating system will use an OSA-Express network interface card providing Gigabit Ethernet access to the LSU network backbone, and will route network traffic to and from the appropriate Linux systems.

Disk storage will be provided by adding capacity to the LSU existing IBM Shark SAN storage unit. z/VM virtualization allows this storage to be carved into "minidisks" of a desired size and allocated to a Linux system for use in filesystems or as swap space. z/VM itself will use some of this storage for various system functions, such as spool, paging, and temporary work space.

Users will access the Linux systems over the LSU network by using a Secure Shell (SSH) terminal session from any desktop PC or workstation. SSH is freely available and can be downloaded from the LSU web site. If the user has access to X-Window server software, the Linux systems can fully support an X11 graphical interface at the desktop for many applications.

The following figure illustrates the logical layout of the proposed z/VM-Linux LPAR and the system services used to support it:

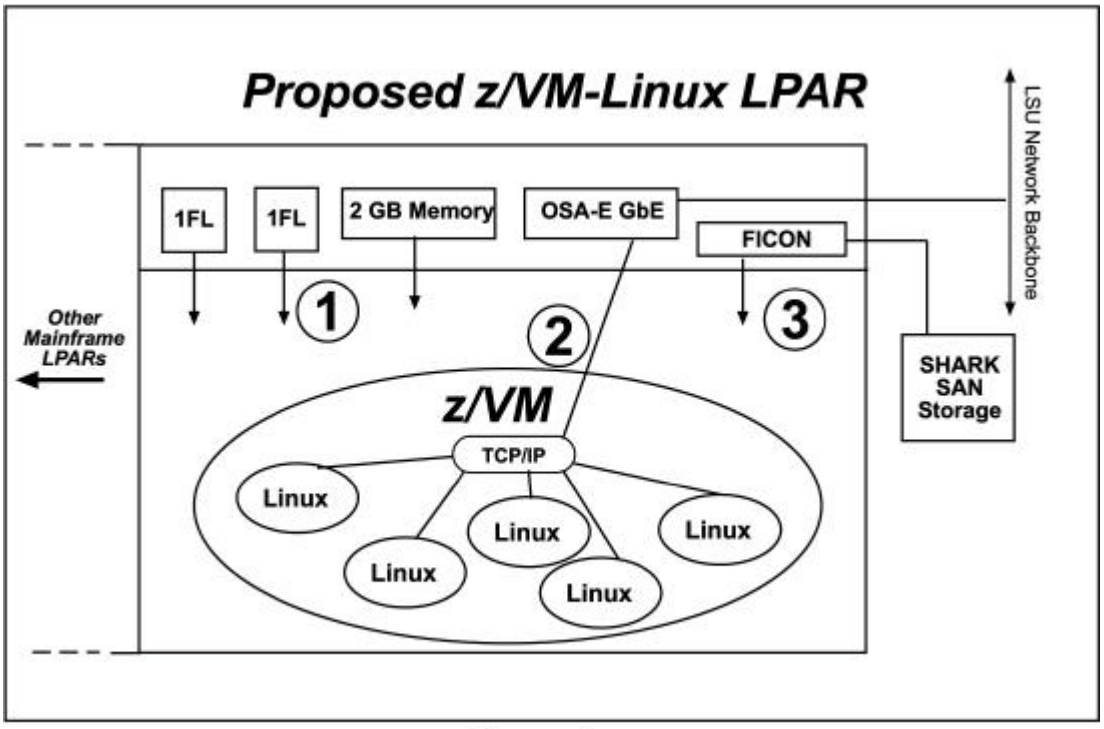


Figure 1

Notes on Figure 1:

1. Two IFL processors and two gigabytes of memory are used by z/VM to provide processing capability to the Linux virtual systems.
2. Access to the LSU network backbone is through the z/VM TCP/IP process, which directly controls the OSA-Express Gigabit Ethernet interface. IUCV virtual devices provide the connectivity between each Linux virtual system and z/VM's TCP/IP process.
3. LSU's Shark storage unit provides disk storage to z/VM where it is allocated in virtual "minidisks" to each Linux virtual system for use as filesystems and swap space.

The following figure shows a typical layout for three "penguin colonies", each having a unique standard Linux template system from which the others in the colony are cloned. The connecting lines represent IUCV virtual network devices providing connectivity to the network through the z/VM TCP/IP facility.

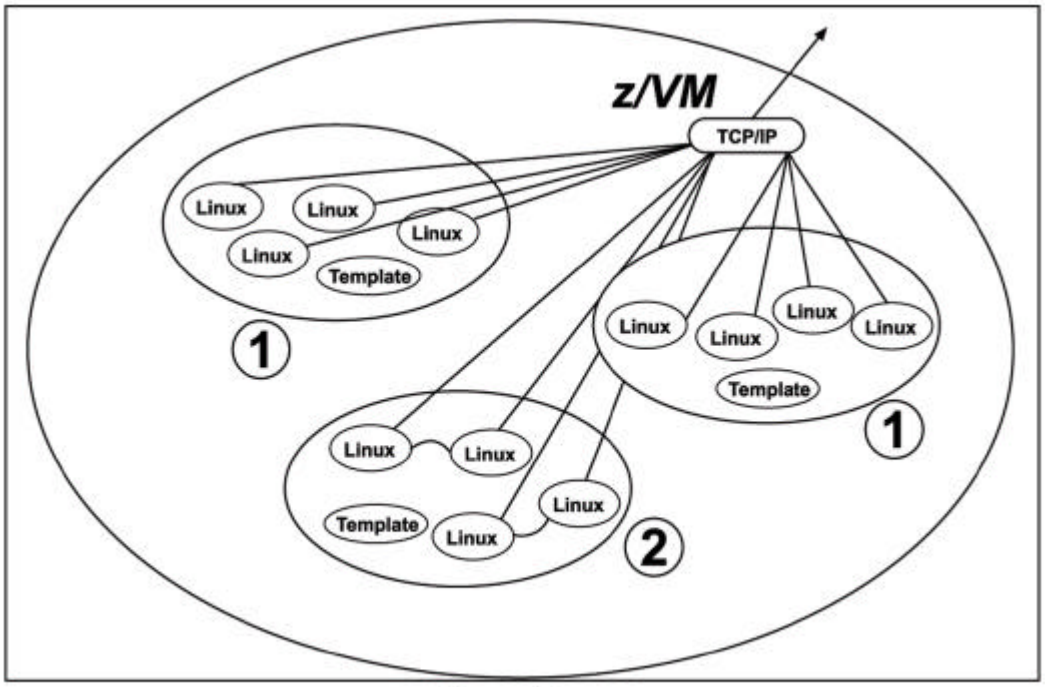


Figure 2

Notes on Figure 2:

1. Two typical groupings of Linux systems similar to what would be used to provide Linux services for a couple of Computer Science undergraduate classes on operating systems. If needed, each Linux system could be easily "reloaded" from its group template.
2. A grouping illustrating how the IUCV virtual network devices could be used to connect two Linux systems together in addition to providing "outside" network connectivity. This would be useful for a class on distributed computing, alleviating the need for real cables, hubs, and other network equipment, while enabling the student to experiment with TCP/IP sockets and other inter-system mechanisms.

Recoverability will be addressed in two major areas, at the z/VM level and at the Linux virtual system level. For z/VM, standard best practices will be implemented, with weekly full backups of the z/VM environment and ad hoc backups of changed components, such as the user directory, as needed. At the Linux virtual system level, the Tivoli Storage Manager Backup/Archive client will be assembled into each system template so that each Linux virtual system can automate its backups overnight to the LSU central repository, managed by a TSM server process running in the mainframe's OS/390 LPAR.

Where possible, we plan to configure the Linux filesystems containing the operating system and utilities as read-only z/VM minidisks. This should minimize exposure to hacking practices, such as root kits, which modify Linux system components, since these filesystems are write-protected at the underlying z/VM level.

Overall system management of the z/VM-Linux environment is accomplished with standard z/VM monitoring and system administration tools. These tools enable performance monitoring, control of the Linux virtual systems, and overall management of the user environment.

This architecture is easily scalable from several hundred Linux virtual systems to several thousand, and is dependent on the amount of processor, memory, and disk storage available to the LPAR.

H. Implementation Approach

The implementation schedule is ambitious because of the staff expertise already gained with the current Linux/390 project in the area of consolidating production servers. The intent is to build upon the existing experience to expedite the effort. Assuming funding by April 1, 2002, the plan is to have the hardware installed by early summer and the software ready for the pilot phase by the start of the fall semester. The pilot project will include at least one Computer Science course, tentatively in the operating system area, with the addition of two courses for the spring in Computer Science and one other academic department. By summer, 2003, the service will be available on a larger scale. Seminars describing the results will be presented starting in the spring 2003.

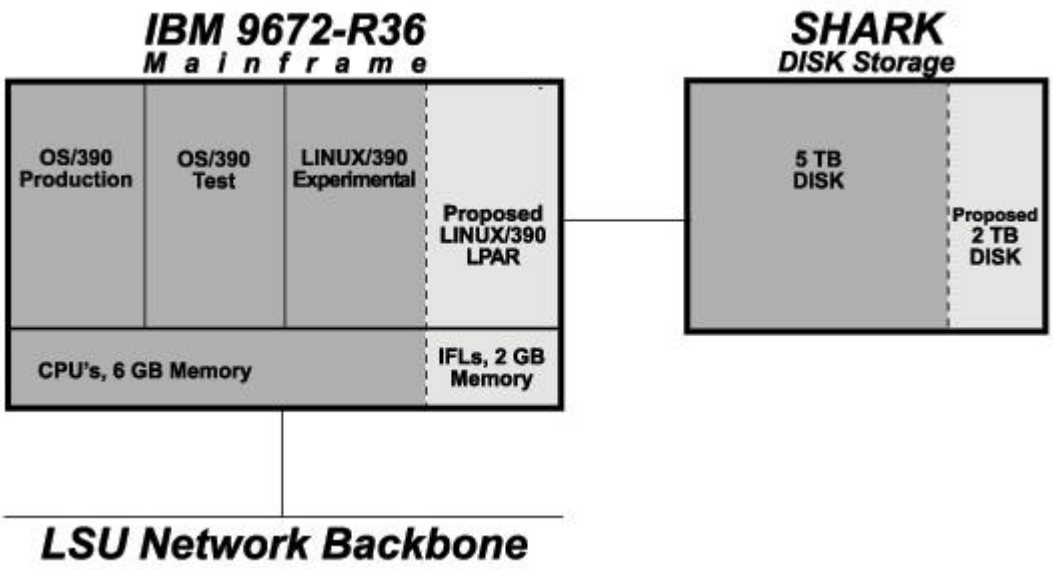
	Year 2002									Year 2003							
	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
* Bid, order and receive hardware	XXXX																	
* Prepare site	XX																	
* Identify and plan pilot project	XXX																	
* Install and test hardware	XXX																	
* Install software	XXXX																	
* Prepare management environment	XXX																	
* Pilot project (CSC)		XXXXXXXX																
* Pilot project assessment							XXX											
* Prepare/Present on-campus seminars										XXXXXX								
* Second semester pilot courses										XXXXXXX								
* Project assessment													XXX					
* Prepare/Present state agency seminars													XXXXXX					
* Develop plans for full deployment													XXXXXX					

I. Assessment of Risks

LSU has experience and a successful record in developing, maintaining and supporting large-scale IT projects and in managing grant funds. There is a clear demand for Linux services on campus and the proposed architecture is reasonable and strategic. The major risk is associated with providing long-term funding for maintenance, support and upgrades. However, successful deployment of this innovative approach for providing virtual Linux services will make a strong case for continued funding within LSU resources. It is our intent to make that justification compelling.

J. Integration with Existing Technologies

LSU is able to propose this ambitious project only by taking full advantage of the strengths of the existing IT infrastructure. This concept is designed to deploy innovative services by leveraging LSU's current investments in technology and staff expertise to the maximum. The IBM S/390 is the cornerstone of LSU enterprise services. The proposed additional processor capacity will be appended to the existing processor complex. The Linux/390 and z/VM software systems are already installed on the current hardware as a result of a research project in progress. The proposed disk storage is an extension of the existing multi-platform SAN environment and will be incorporated into current production storage management procedures. The network access will be provided via the existing high-speed campus backbone without need for additional expense. The integration is summarized in the following figure. All operational support will be provided by the current Computing Services operations staff 7x24x365. And, most importantly, the talented technical staff is enthusiastic about the opportunity.



K. Project Budget and Costs

1. Equipment

Linux-only Processors, Memory and Network Interface for IBM 9672-R36: Two Integrated Facility for Linux (IFL) processors to be attached to the LSU IBM 9672-R36 enterprise server, two gigabytes of memory to be shared by the processors and one gigabit Ethernet card for connection to the campus high-speed network. The pricing for these items is bundled. This hardware will be used with the z/VM and Linux/390 software to provide the virtual Linux systems. Hardware maintenance for the package will be $1,332 per processor after year 1.

Disk Storage: 2.46 Terabytes of online storage as an upgrade to existing SAN (IBM 2105 enterprise storage SHARK hardware). This storage will be used primarily for the Linux virtual systems, including user storage and some z/VM system requirements. Purchase includes 3-year warranty.

Ficon Channels for Enterprise Storage: Two Ficon adapters for high-speed connection from the disk hardware to the processor complex. The current configuration does not provide adequate connectivity. Maintenance included in the warranty.

Ficon Channels for Processor: Two Ficon channels for high-speed connection from the processor complex to the disk storage. Maintenance included with processor complex.

Cost Summary:

Item	Quantity	Unit Price	Total
Processor, Memory, Interface Package	1	$349,300	$349,300
Disk Storage	1	$215,500	$215,500
Ficon Channels for Disk Storage	2	$8,800	$17,600
Ficon Channels for Processor	2	$13,000	$26,000
Total			**$608,400**

2. Software

z/VM: z/VM operating system software runs on the IBM 9672 processor complex. This software provides the virtualization technology to create the virtual Linux systems. The software is licensed per processor. The annual software maintenance after the first year is $11,500 per processor.

Red Hat Linux Distribution for IBM S/390: Consisting of the operating system software distribution on CDs and documentation.

Cost Summary:

Item	Quantity	Unit Price	Total
z/VM Operating System	2	$45,000	$90,000
Red Hat Distribution/Docs	1	$500	$500
Total			**$90,500**

3. Telecommunications

Will use existing LSU network capability.

4. Professional/Contracted Services

None

5. Other

IFL Processor Maintenance for Year 2: Funds are included for hardware maintenance for Year 2 of the project at a cost of $1,332 each.

z/VM Software Maintenance: Annual software maintenance per processor after first year.

IBM Linux/390 Support for Year 1 & 2: Annual cost for support line offering on Linux/390 for up to three processors, 7x24x365, at $38,313 per year.

Training: Funds are included to send one junior IT professional to a one-week training session on Linux/390 system management - $2,000 for travel and $2,000 for registration.

Cost Summary:

Item	Quantity	Unit Price	Total
Processor Maintenance Year 2	2	$1,332	$2,664
z/VM Software Maintenance Year 2	2	$11,500	$23,000
IBM Linux Support Year 1 & 2	2	$38,313	$76,626
Linux/390 Training Session	1	$4,000	$4,000
Total			**$106,290**

V FUNDING REQUESTED

There are no external funding sources for this project

Funding Category	Total Cost	Other Sources	Funding Requested
Equipment	$608,400	$0	$608,400
Software	$90,500	*	$90,500
Telecommunications	0	0	0
Professional Services	0	0	0
Other	$106,290	0	$106,290
Total	**$805,190**	**$0**	**$805,190**

?? Note – This project will take advantage of current LSU campus licenses for software and will also be eligible for distribution of enterprise software at no charge from IBM via the Scholars program. See letter of support from IBM Program Director for Higher Education.

VI COST/BENEFIT ANALYSIS

The objective of this project is to provide Linux services currently not available except on a limited basis. Long-term cost-savings are anticipated in the area of server consolidation, reduction of complexity, economies of scale, and the ensuing technology transfer.

For example, virtual Linux services eliminate the need for new and distinct computing labs dedicated to Linux, as opposed to general-purpose Windows desktops, the LSU standard. Conservatively, such a Linux lab with 40 desktops will cost approximately $212,000 to establish with $56,000 per year in operating expenses. A project of this magnitude using the traditional approach will require, at a minimum, two dedicated labs. Since current LSU labs are already heavily-used and space is unavailable, the proposal will provide Linux services without dedicated labs resulting, conservatively, in avoidance of over $400,000 in lab startup costs and over $110,000 in lab operating expenses.

Similarly, we investigated the possibility of using IBM RS/6000 technology to provide virtual Linux services. That analysis showed the need for an IBM S85 class machine. The configuration complete with the capability of creating virtual Linux images will cost in the range of $850,000 plus disk storage. Based upon the technical assessment, the IBM S/390 approach is more cost-effective and better-suited for LSU.

This project proposes to use LTIF funds for acquisition and maintenance of the hardware/software for two years and to use LSU funds for future years.

Expenditure Increase (Decrease)

STATE COSTS	2002-03	2003-04	2004-05 (and future years)
Personnel Services	**0**	**0**	**$60,000(6)**
Operating Services	**$38,313(1)**	**$63,977(5)**	**$63,977(7)**
Professional Services	**0**	**0**	**0**
Supplies/Software	**$90,500(2)**	**0**	**0**
Other Charges	**$4,000(3)**	**0**	**0**
Equipment	**$608,400(4)**	**0**	**0**
TOTAL	**$741,213**	**$63,977**	**$123,977**

(1) – IBM Linux/390 support (LTIF Funds)
(2) – z/VM software and Red Hat distribution (LTIF Funds)
(3) – Training class (LTIF Funds)
(4) – Hardware acquisition (LTIF Funds)
(5) – IBM Linux/390 support, z/VM support, and hardware maintenance (LTIF Funds)
(6) – New system administrator position (LSU Funds)
(7) – IBM Linux/390 support, z/VM support, and hardware maintenance (LSU Funds)

	2002-03		2003-04		2004-05	
PERSONNEL (By Classification)	**No. Pos.**	**Av. Sal.**	**No. Pos.**	**Av. Sal.**	**No. Pos.**	**Av. Sal.**
Sys. Admin. (1)					1	$60,000

(1) – Anticipate the need for an additional Linux system administrator position during the third year and future years of the project to cope with the growth associated with server consolidation on a large scale.

MEANS OF FINANCING FOR ABOVE EXPENDITURES

FISCAL YEAR	STATE GEN. FUND	AGENCY SELF GENERATED	RESTRICTED/ OTHER	FEDERAL FUNDS	LOCAL FUNDS
2002-03	**$741,213(1)**				
2003-04	**$63,977(2)**				
2004-05	**$123,977(3)**				

(1) – LTIF Funds
(2) – LTIF Funds
(3) – LSU Funds

VII SIGNED STANDARD FORM

All standard proposal forms must be submitted along with a cover letter signed by the Secretary, Undersecretary (or their equivalents) and the Project Manager.

_____ _____

Mark Emmert, Chancellor

_____ _____

Daniel M. Fogel, Executive Vice Chancellor and Provost

_____ _____

Jim Bates, Director, Office of Sponsored Programs

_____ _____

Ronald D. Hay, CIO and Executive Director of Computing Services

ATTACHMENTS

Letter of Support - Dr. Iyengar, LSU, Chair, Dept. of Computer Science
Letter of Support - Dr. Moser, LSU, Head, Dept. of Experimental Statistics
Letter of Support - Nancy Brittle, IBM, Program Director, Linux in Higher Education
IBM Case Study - Marist College, Linux/390